SECTION 16

INTERIOR PLUMBING

16-01 SCOPE: The work covered by this section of the specifications consists in furnishing all plant, labor, equipment, appliances and materials not furnished by the Government, and in performing all operations in connection with plumbing, including all items of special equipment specified herein, complete, in strict accordance with this section of the specifications and the applicable drawings, and subject to the terms and conditions of the contract.

16-02 APPLICABLE SPECIFICATIONS: The following specifications and standards of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification:

a. Federal Specifications:

HH-C-536	Compound; Plumbing-Fixture-Setting
HH-G-116	Gaskets; Plumbing-Fixture-Setting
HH-I-567	Insulating, Pipe, Laminated Felt
HH-P-117	Packing; Jute, Twisted
O-S-602	Sodium Hypochlorite
QQ-L-156	Lead; Calking
QQ-L-201	Lead; Sheet
WW-N-351	Nipples, Pipe; Brass, Steel and Wrought-Iron
WW-P-401	Pipe and Pipe-Fittings; Soil, Cast-Iron
WW-P-406	Pipe; Steel and Ferrous Alloy (for) Ordinary Uses (Iron-Pipe Size)
WW-P-460	Pipe-Fittings; Bronze (Screwed), 125-Pound and 250-Pound
WW-P-491a	Pipe-Fittings; Cast-Iron, Drainage
WW-P-501b	Pipe Fittings; Cast-Iron, Screwed 125 and 250 lb.
WW-P-521b	Pipe-Fittings; Malleable Iron (Screwed) 150-Pound
WW-P-541a	Plumbing Fixtures; (for) Land Use
WW-P-542	Plumbing Fixtures; (for) Land Use (Formed-Metal Plumbing Fixtures)
WW-T-799a	Tubing, Copper, Seamless (for Use with Solder-Joint or Flared-Tube Fittings)
WW-U-516	Unions; Brass or Bronze, 250-Pound
WW-U-531	Unions; Malleable-Iron or Steel, 250-Pound
WW-V-51a	Valves, Bronze; Angle, Check and Globe, 125- and 150-Pound, Screwed and Flanged (for Land Use)
WW-V-54	Valves, Bronze, Gate; 125- and 150-Pound, Screwed and Flanged (for Land Use)
WW-V-58	Valves, Cast Iron, Gate, 150- and 250-Pound, Screwed and Flanged
GGG-P-351a	Pipe-Threads; Taper (American National)

b. U. S. Department of Commerce Commercial Standards:

CS111-13 Plumbing Fixtures, Earthenware (Vitreous-Glazed)

16-03 GENERAL: The drawings indicate the general arrangement of the plumbing. Details of proposed departures due to actual field conditions or other causes shall be submitted to the Contracting Officer for written approval. The Contractor shall carefully examine the drawings and shall be responsible for the proper fitting of materials and equipment in each building as indicated, without substantial alteration.

a. Standard Products: The equipment and fixtures to be furnished under this specification shall be the standard products of approved American manufacturers. Where two or more units of the same class of equipment are required, these units shall be products of a single manufacturer; however, the component parts of the system need not be the products of the same manufacturer.

b. Workmanship: All equipment; valve, pipe, fittings and material shall be installed in accordance with the recommendations of the manufacturer and the best standard practice.

c. Utilities: Water and drainage piping shall be extended to points outside the building as shown on the drawings, where the pipes shall be capped or plugged and left ready for future connection by others. If trenches are closed or the pipes are otherwise covered before being connected to the street mains, the location of the end of each plumbing utility shall be marked with a stake or by other acceptable means. Building service stub-out locations shall be approved by the Contracting Officer before laying pipe.

d. Cross Connections and Interconnections: No plumbing fixture, device or piping shall be installed which will provide a cross connection or interconnection between a distributing supply for drinking or domestic purposes and a polluted supply such as a drainage system or a soil or waste pipe which will permit or make possible the backflow of sewage, polluted water or waste into the water-supply system. Where it is necessary to cross a sewer line with a water line a 1 ft. minimum clearance between lines shall be maintained and the sewer line shall be cast-iron soil pipe for a minimum of 10 feet each side of the crossing.

e. Specifications: Materials required which are not covered by the detailed specifications shall meet the requirements of specifications listed hereinbefore and the items specified on the drawings and shall be of the required class, grade and type. Shop tests of pipe, valves and fittings, required by Federal Specifications to be conducted in the presence of a Government inspector, are waived.

f. Connections to Equipment and Fixtures Furnished by the Government or Specified Elsewhere: The Contractor shall provide all necessary material and labor to connect to the plumbing system, all fixtures and equipment

having plumbing connections and which are furnished by the Government, if any, or are specified in other sections of these specifications.

g. Drawings: The drawings show the general arrangement of all piping; however, where local conditions necessitate a rearrangement, the Contractor shall prepare, and submit for approval, drawings of the proposed rearrangement. Because of the small scale of the drawings, it is not possible to indicate all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the structural and finish conditions affecting all his work and shall arrange such work accordingly, furnishing such fittings, traps, valves and accessories as may be required to meet such conditions. Invert elevations shall be checked and approved by the Contracting Officer before laying drain piping.

h. Shop Drawings: As soon as practicable after the award of contract and before purchase, fabrication or installation of equipment, complete control wiring diagrams and shop drawings of all major items of equipment shall be submitted to the Contracting Officer for approval.

i. Cutting and Repairing: The work shall be carefully laid out in advance, and any cutting of construction shall be done only with the written permission of the Contracting Officer. Cutting shall be carefully done and damage to buildings, piping, wiring or equipment as a result of cutting for installation shall be repaired by skilled mechanics of the trade involved at no additional expense to the Government.

j. Protection of Fixtures, Materials and Equipment: Pipe openings shall be closed with caps or plugs during installation. Fixtures and equipment shall be tightly covered and protected against dirt, water and chemical or mechanical injury. At the completion of the work the fixtures, materials and equipment shall be thoroughly cleaned and delivered in a condition satisfactory to the Contracting Officer.

16-04 LIST OF MATERIALS, FIXTURES AND EQUIPMENT: Within 45 days after award of contract and before any materials, fixtures or equipment are purchased, the Contractor shall submit to the Contracting Officer for approval, a complete list, in triplicate, of Contractor-furnished materials, fixtures and equipment to be incorporated in the work, together with the names and addresses of the manufacturers and their catalog numbers and trade names. The Contractor shall also furnish other detailed information, when so directed by the Contracting Officer. No consideration will be given to partial lists submitted from time to time. Approval of materials will be based on manufacturers' published ratings. Any materials, fixtures and equipment listed which are not in accordance with the specification requirements may be rejected, and the Contracting Officer shall then have the right to select materials, fixtures and equipment therefor. All fixtures, valves, fittings and equipment shall be of American manufacture. If the Contractor fails to submit for approval within the specified time, or any authorized extension thereof, a list of materials and equipment hereinbefore specified, the Contracting Officer shall select a complete line of materials and equipment. The selection thus made by the Contracting Officer shall be final and binding and the items shall be furnished and installed by the Contractor without change in contract price or time of completion.

16-05 EXCAVATING, TRENCHING AND BACKFILLING:

a. Excavating and Trenching: Trenches for all underground pipe lines shall be excavated to the required depths. The bottoms of trenches shall be tamped hard and graded to secure the required fall. Bell holes shall be excavated so that pipe will rest on solid ground for its entire length. Rock, where encountered, shall be excavated to a depth of 6 inches below the bottom of the pipe, and before pipe is laid the space between bottom of pipe and rock surfaces shall be filled with gravel. Sewer and water pipes shall be laid in separate trenches, except where otherwise noted on the drawings.

b. Backfilling: After pipe lines have been tested, inspected and approved by the Contracting Officer, and prior to backfilling, forms shall be removed and the excavation shall be cleaned of all trash and debris. Material for backfilling shall consist of the excavation, or borrow of sand, gravel or other materials approved by the Contracting Officer and shall be free of trash, lumber or other debris. Backfill shall be placed in horizontal layers not exceeding 9 inches in thickness and properly moistened to approximate optimum requirements. Each layer shall be compacted by hand or machine tampers or by other suitable equipment to a density that will prevent excessive settlement or shrinkage. Backfill shall be brought to a suitable elevation above grade to provide for anticipated settlement and shrinkage.

16-06 MATERIALS AND EQUIPMENT: The following materials and equipment shall conform to the respective specifications and the other requirements specified below:

a. Calking Lead: Federal Specification QQ-L-156, type I.

b. Fittings:

(1) Cast-Iron Threaded Fittings: Federal Specification WW-P-501, type II, class A or B.

(2) Cast-Iron Drainage Fittings: Federal Specification WW-P-491, type III.

(3) Fittings for Copper Tubing: Fittings for copper tubing shall be of wrought or cast bronze, or of wrought copper. Fittings shall be of the soldered joint type and shall be completely fabricated at the factory. Bronze fittings shall contain not less than 85 percent copper and shall conform to Federal Specification WW-P-460. All fittings for each piping system shall be of the same material and type.

(4) Malleable-Iron Fittings: Federal Specification WW-P-521, type II, zinc-coated.

(5) Nipples: Nipples shall conform to the applicable requirements of Federal Specification WW-N-351. Nipples shall be of the same materials as the pipe system in which they are used.

(6) Unions: Unions on non-ferrous pipe or tubing shall be bronze, of the composition specified for bronze fittings in Federal Specification WW-U-516. Ferrous pipe shall be equipped with galvanized malleable iron unions, type B, Federal Specification WW-U-531.

c. Plumbing Fixtures: Plumbing fixtures shall conform to the requirements of Federal Specification WW-P-541 or WW-P-542, as applicable, except that where cross-or ball-style faucet handles are specified, dome-shield-style handles will be acceptable.

d. Plumbing-Fixture-Setting Compound: Federal Specification HH-C-536.

e. Plumbing-Fixture-Setting Gaskets: Federal Specification HH-G-116, type best suited for the work.

f. Pipe and Tubing:

(1) Cast-Iron Soil Pipe and Fittings: Federal Specification WW-P-401, coated. Coating shall be coal tar pitch varnish conforming to ASTM A74-42.

(2) Copper Tubing: Federal Specification WW-T-799, type K, hard drawn.

(3) Steel Pipe: Federal Specification WW-P-406, type I, II or III, class A, zinc-coated.

g. Sheet Copper: Federal Specification QQ-C-501, soft temper.

h. Sheet Lead: Federal Specification QQ-L-201.

i. Twisted Jute Packing: Federal Specification HH-P-117, type II.

j. Valves:

(1) Angle, Check and Globe Valves: Angle, check and globe valves shall conform to the requirements of Federal Specification WW-V-51a, class B, type as suitable for the application, modified for use in connection with copper tubing.

(2) Gate Valves: Bronze gate valves shall conform to the requirements of Federal Specification WW-V-54, type I, II or III, class B, modified for use in connection with copper tubing where required.

16-07 SOIL, WASTE, DRAIN AND VENT PIPING: All underground soil, waste and drain piping, and above ground soil, waste, drain and vent piping larger than 2-1/2 inch, shall be coated, extra-heavy, hub-and-spigot, cast-iron soil pipe and fittings, except where otherwise noted on drawing. All above ground soil, waste, drain and vent piping 2-1/2 inch and smaller shall

be of zinc-coated steel pipe. Above ground threaded drain and waste piping shall have drainage fittings. Fittings on dry vents may be galvanized malleable-iron or cast-iron. Drains below finished floor and to points five foot outside the building shall be made up with extra heavy hub and spigot cast iron soil pipe and fittings.

a. Drainage Pipe and Vent Piping: All horizontal soil and waste pipes shall be given a grade of 1/4-inch per foot, except sizes 4" and over may have a minimum pitch of 1/8-inch per foot where required. All main vertical soil and waste stacks shall be extended full size to and above the roof line as vents, except where otherwise specifically indicated. Where practicable, two or more vent pipes shall be connected together and extended as one pipe through the roof. Vent pipes in roof spaces shall be run as close as possible to the under side of the roof, ceiling or beams with horizontal piping pitched down to drain stacks without forming traps in pipes, using fittings as required. Vertical vent pipes may be connected into one main vent riser above vented fixture. Where circuit vent or wet vent from any fixture or line of fixtures is connected to a vent line serving other fixtures, the connection shall be at least 4 feet above the floor on which the fixtures are located, to prevent use of any vent line as a waste. Horizontal waste lines receiving the discharge from two or more fixtures shall be provided with end vents unless separate venting of fixtures is noted. The cast-iron hub-and-spigot pipe inside of buildings shall be extended 3 inches above floor where the floor is supported on the ground. No piping except as otherwise shown or approved shall be cast in concrete.

(1) Fittings: Changes in pipe size on soil, waste and drain lines shall be made with reducing fittings or recessed reducers. Changes in direction shall be made by the appropriate use of 45 degree wyes, half wyes, long-sweep 1/4 bend, 1/6, 1/8 or 1/16 bends, except that sanitary tees may be used on vertical stacks and short 1/4 bends or elbows may be used in soil and waste lines where the change in direction of flow is from the horizontal to the vertical, and on the discharge from water closets. Where it becomes necessary because of space conditions to use short-radius fittings in any other location, the written approval of the Contracting Officer shall be obtained before they are installed.

(2) Union Connections: Slip joints will be permitted only in trap seals or on the inlet side of the traps. Tucker or hub drainage fittings shall be used for making union connections wherever practicable in connection with dry vents. The use of long screws and bushings, except fittings bushed in the sand, is prohibited.

(3) Joints:

(a) Cast-Iron Pipe: Joints in hub-end-spigot, cast-iron soil, waste and vent pipes and threaded pipe or calking ferrules, shall be firmly packed with oakum or hemp and calked with lead at least one inch deep. Threaded pipe shall have a ring or half-coupling screwed on to form a spigot end.

(b) Threaded Pipe: Threaded joints shall have American National taper screws threads conforming to the requirements of Federal Specification GGG-P-351 with graphite and oil compound applied to the male thread.

16-08 CLEANOUT PLUGS AND TEST TEES: Cleanouts shall be the same size as the pipe, except that cleanout plugs larger than 4 inches will not be required. Except as otherwise shown on the drawings, cleanouts installed in connection with cast-iron hub-and-spigot pipe shall consist of a long-sweep 1/4 bend or one two 1/8 bends extended to an easily accessible place, or where indicated on the drawings. An extra-heavy, cast-brass ferrule with countersunk trap screw cover shall be calked into the hub of the fitting and shall be flush with the floor, except as otherwise shown on the drawings. Test tees with cast-iron cleanout plugs shall be installed at the foot of all soil, waste and drain stacks and on each building drain outside the building.

16-09 FLASHINGS: Vent pipes and roof drains shall be flashed and made watertight at the roof with 16-ounce, soft sheet copper or 6 pound sheet lead. Flashings shall extend not less than 8 inches from the vent pipes and roof drains in all directions. Flashings for steel vent pipe shall be extended up the vent pipes a minimum of 6 inches at which point threaded standard cast-iron or malleable iron recess roof coupling shall be installed to form counter-flashing or rain guards, unless otherwise indicated on the drawings. Flashings in connection with cast-iron pipe vents shall be turned down 1 inch into the pipes or hubs.

16-10 TRAPS: Each fixture and piece of equipment requiring connections to the drainage system, except fixtures with continuous waste, shall be equipped with a trap. Each trap shall be placed as near to the fixture as possible and no fixture shall be double-trapped. Traps installed on hub-and-spigot pipe shall be extra-heavy cast-iron. Traps installed on threaded pipe shall be recess drainage pattern. Traps in connection with bathtub wastes shall have cleanout plugs unless otherwise indicated on the drawings.

16-11 PIPE SLEEVES, PIPE HANGERS, PIPE SUPPORTS AND FIXTURE SUPPORTS: Pipe sleeves, pipe hangers, pipe supports and fixture supports shall be furnished and set, and the Contractor shall be responsible for their proper and permanent location. Pipe will not be permitted to pass through footings, columns, or beams, unless noted on the drawings or approved by the Contracting Officer.

a. Pipe Sleeves: Pipe sleeves shall be installed and properly secured in place at all points where pipes pass through masonry or concrete. Pipe sleeves, except sleeves in footings, shall be two-sizes larger than the pipe and in the case of insulated pipes, shall be of sufficient diameter to provide approximately 1/4-inch clearance around the insulation. Pipe sleeves in footings shall be of cast-iron or steel pipe and shall be not less than 4 inches larger in diameter than the pipe to be installed. Pipe sleeves in walls and partitions shall be of cast-iron, wrought-iron or steel pipe. Pipe sleeves in floors shall be of galvanized sheet steel weighing 0.90625 pound per square foot (Nr. 26 galvanized sheet). Sleeves in floors shall extend not less than one inch and not more than 2 inches above the finished floor, and after installation of the pipe, the space around the pipe shall be packed with plastic material and made watertight. Flashing sleeves shall be installed where pipes pass through waterproofing membranes. The sleeves shall be provided with an integral flashing flange or a clamping device to which a flashing shield can be clamped or soldered. Flashing shields shall be of 16-ounce soft sheet copper, shall extend not less than 8 inches from the sleeve, and flashing flanges and shields shall be thoroughly mopped into the membrane. The space between the pipe and sleeve shall be made watertight by inserting a picked oakum gasket and filling the remaining space with poured lead and calking thoroughly.

b. Pipe Hangers and Supports: Horizontal runs of copper tubing shall be supported by steel hangers spaced not more than 8 feet on centers, unless otherwise shown on the drawings. The hangers shall be of the types detailed on the drawings or other types approved by the Contracting Officer. Hangers shall be hung from the concrete structure with rods and concrete inserts. Horizontal runs of vent pipe shall be supported by adjustable expansion pipe hangers having bolted hinged loops and turnbuckles, or an approved equal. Chain or perforated extension bar hangers will not be permitted. Hangers on pipe shall be spaced not more than 10 feet on centers. The hangers shall be anchored with a lag screw having a diameter equal to that of the supporting rod, or to the proper concrete inserts. Vertical runs of the pipe shall be supported by heavy wrought-iron clamps or collars spaced not over 10 feet apart for steel pipe and with copper or brass clamps for copper pipe. Hangers and clamps shall be of a size proportionate to the weight of the pipe supported.

c. Fixture and Equipment Supports and Fastenings: Fixtures and equipment shall be supported and fastened in a satisfactory manner. Where secured to wood partitions, fixtures and equipment shall be fastened with brass wood screws. Fastening to concrete walls shall be with brass bolts or machine screws in lead-sleeve type anchorage units, or with 1/4 inch brass expansion bolts, with 20 threads to the inch, of sufficient length to extend at least 3 inches into solid concrete, and fitted with loose tubing or sleeve of proper length to bring expansion sleeves into solid concrete. Where wood screws are used, screws shall go into solid wood, such as wood inserts, floor joints, studs, or solid pieces set between studs. Through-bolts shall be provided with plates or washers at back, set so that heads, nuts, and washers will be concealed by plaster. Exposed heads of bolts and nuts shall be hexagonal with rounded tops finished and chromium-plated, with chromium-plated hexagonal nuts to conceal end of bolts where exposed. Exposed nuts and heads of screws shall be provided with chromium-plated brass washers.

16-12 FLOOR, WALL AND CEILING ESCUTCHEON PLATES: Where uncovered exposed pipes pass through floors, finished walls, or finished ceilings, or other finished surfaces they shall be fitted with chromium-plated cast-brass plates on chromium plated pipe, or with cast-iron or steel plates on ferrous pipes, except as otherwise specifically noted. Plates shall be large enough to completely close the holes around the pipes and shall be octagonal or round, with the least dimension not less than 1-1/2 inches larger than the diameter of the pipe. Plates shall be secured in approved manner.

16-13 WATER PIPE, FITTINGS AND CONNECTIONS:

a. Copper Tubing: All domestic hot water and cold water piping shall be made up with hard drawn Type K copper tubing of sizes corresponding to those shown on the drawings. Piping shall be made up with wrought copper or bronze or cast bronze solder fittings, except as otherwise shown or specified.

b. Installation:

(1) Mains, Branches and Runouts: Pipe and tubing shall be cut with mechanical pipe cutters accurately to measurements established at the building by the Contractor and shall be worked into place without springing or forcing. Care shall be taken not to weaken the structural portions of the building. Piping above ground shall be run parallel with the lines of the building, unless otherwise shown or noted on the drawings. Branches from service lines may be taken off top of main, bottom of main, or side of main, using such crossover fittings as may be required by structural or installation conditions. Service pipe, valves and fittings shall be kept a sufficient distance from other work to permit finished covering not less than 1/2 inch from such other work and not less than 1/2 inch between finished covering on the different services. No water piping shall be buried in floor slab or walls unless specifically indicated on the drawings. Changes in sizes shall be made with reducing fittings. The use of long screws and bushings will not be permitted.

(2) Expansion and Contraction of Tubing: Allowance shall be made throughout for expansion and contraction of tubing. Horizontal runs of tubing over 50 feet in length shall be anchored to the wall or to the supporting construction about midway on the run to force expansion, evenly divided, toward the ends.

(3) Air Chambers: Air chambers shall be provided on both hot and cold supplies, near each faucet or control valve, as applicable, and where not definitely shown on the drawings shall consist of a 12-inch length of tubing fitted with a cap of the same diameter as the branch supply.

c. Joints:

(1) Threaded Pipe: After cutting and before threading, pipe shall be reamed and shall have burrs removed. Screw joints shall be made with graphite and oil or with an approved graphite compound applied to male threads only. Threads shall be full-cut, and not more than three threads on the pipe shall remain exposed. Calking of threaded joints to stop or prevent leaks will not be permitted. Unions shall be provided where required for disconnection. Threads shall be National Taper Pipe Threads.

(2) Tubing: Tubing shall be cut square with mechanical cutters and burrs shall be removed. Both inside of fittings and outside of tubing shall be well cleaned with steel wool before sweating. Care shall be taken to prevent annealing of fittings and hard-drawn tubing when making connections. Installation shall be made by competent, thoroughly experienced workmen and in accordance with the manufacturer's recommendations. Mitering joints for elbows and notching straight runs of pipe for tees will not be permitted. Joints for soldered fittings shall be made with a non-corrosive paste flux and solid string of wire solder composed of 40 percent tin and 60 percent lead. Cored solder will not be permitted.

d. Insulation: After piping has been cleaned and satisfactory tests have been completed, not less than 3/4-inch thick non-conducting wool felt conforming to Federal Specification HH-I-567 specifically designed for copper tubing (40 to 212 degree) shall be installed on all hot and cold water piping within the building including risers in furred spaces and chases. Branches to fixtures in finished rooms shall not be covered. Plated brass pipe shall not be covered. Wool felt covering shall be sectional, preformed, removable type with inner liner of impregnated felt suitable for either hot or cold water pipes. Covering shall be constructed of either solid wool or preshrunk indented wool felt and have an outer layer of either flat vegetable paper or asbestos paper. Jackets shall be cotton sheeting. Straps shall be placed not over 18 inches apart. At each elbow there shall be two and at each tee there shall be three bands. Coverings shall be neatly finished where pipe hangers occur. Fittings and valves shall be covered with plastic material containing not less than 85 percent magnesia or asbestos finished with a hard smooth surface flush with pipe covering. A ceiling plate shall be installed at point where covering stops. No unions of any kind are to be covered, and covering shall be neatly terminated on each end of such unions with plastic material. Where spaces do not permit the installation of sectional covering on all pipes in wall chases, the covering may be omitted provided the chases are packed full of mineral wool consisting of 85 per cent magnesia or asbestos.

(1) Cold Water Pipes: Great care must be taken in applying the coverings and building up the fittings to keep the air away from the pipes and make the insulation air tight. Liners and jackets shall be waterproof. Double layer construction shall be used with joints and seams staggered.

16-14 UNIONS: Unions on ferrous pipe 2 inches in diameter and smaller shall be malleable-iron, and shall conform to the requirements of Federal Specification WW-U-531, type B, zinc-coated. Unions on non-ferrous pipe shall be as hereinbefore specified. Unions shall not be concealed in walls, ceilings or partitions. Unions shall be installed adjacent to each valve and where required for installation of piping.

16-15 FLOOR DRAINS: Drains shall be made of high grade, strong-tough and even-grained metals. Castings shall be free from blow-holes, porosity, hard spots, excessive shrinkage, cracks, or other injurious defects. They shall be smooth and well cleaned both inside and outside and all fins and roughness shall be removed. Castings shall not be repaired, plugged, braced or "burned-in". The wall thickness of iron castings shall be not less than 1/4 inch. Chromium plating shall conform to the requirements of paragraph D-11 of Federal Specification WW-P-541a. The size of the drain shall be determined by the branch sizes indicated on the drawings.

a. Floor Drains: Floor drains shall conform to the requirements of Federal Specification WW-P-541a, figure 107, with suitable spigot adopter, except as otherwise indicated on the drawings or specified.

b. Washing Machine Drains: Outlets for washing machine drains shall be as detailed and noted on the drawings.

16-16 ELECTRICAL WORK: Electrical equipment and installation shall conform to the applicable requirements of the section on Electrical Work Interior.

16-17 PAINTING: All exterior surfaces of piping to be installed in or through concrete floor fill or tile floors and underground shall be given one coat of acid-resisting paint having a bituminous base. Pipe hangers, supports and all other iron work in concealed space shall be thoroughly cleaned and painted with one coat of asphalt varnish. Finish painting of exposed pipe, pipe covering, hangers, supports and all other ironwork shall conform to the requirements of section on PAINTING; GENERAL of these specifications.

16-18 TYPES OF FIXTURES, FIXTURE TRIMMINGS AND TOILET ACCESSORIES: The items specified herein are the types of fixtures to be furnished and installed, complete with all trimmings and fittings unless otherwise specified under the item.

a. General Requirements: All equipment, fixtures, valves and trim shall be of approved American manufacture. References made herein to outfit numbers, pattern numbers and figure numbers of vitreous-china and enameled-cast-iron-plumbing fixtures are to Federal Specification WW-P-541a, and of enameled formed-metal plumbing fixtures to Federal Specification WW-P-542. Fixtures and trimmings not covered by the Federal Specifications shall be considered special but shall be of equal quality and material. Generally all fixtures, except water closets, shall have the water supply above the rim. Fixtures with the supply discharge below the rim shall be equipped with backflow preventers. Angle stops, straight stops, stops integral with the faucets, or concealed type of lock-shield loose-key pattern stops for concealed supplies shall be furnished and installed with all fixtures, except as otherwise shown on the drawings. Exposed traps and supply pipes for all fixtures and equipment shall be connected to the rough piping systems at the wall, unless otherwise specified under the item. Floor and wall plates and escutcheons shall be as specified hereinbefore or as covered by the outfit numbers. Mounting heights shall be as shown on the drawings.

b. Cross Connections: Fixtures and trimmings shall be designed to prevent the backflow of polluted water or waste into the water-supply system.

c. Fixture Connections: Where space conditions will not permit the use of standard fittings in conjunction with the cast-iron floor flange, short-radius fittings, with approval of the Contracting Officer may be used. Connections between earthenware fixtures and flanges on soil pipe shall be made absolutely gastight and watertight with plumbing-fixture-setting compound or plumbing-fixture-setting gaskets. Rubber gaskets or putty will not be permitted for this connection. Closet bolts shall be not less than 1/4 inch in diameter and shall be equipped with chromium-plated nuts and washers. Fixtures with outlet flanges shall be set at the proper distance from floor or wall to make a first-class joint with the closet setting compound or gasket and the fixture used. Fixtures shall be set plumb. Center lines of fixtures shall be at 90° and parallel to the lines of the building. No fixture shall be set in place until the Contracting Officer has examined and approved the outlet flange.

d. Finish of Fittings and Trimmings: The exposed piping, fittings and trimmings shall be chromium-plated on nickel-plated brass with polished bright surfaces conforming to the requirements of Federal Specification WW-P-541a.

e. Fixtures: Fixtures shall comply with the following list. Outfit Nrs. are Federal Specification WW-P-541a.

(1) Water Closet: Syphon jet, elongated bowl; Outfit Nr. E48C for Duplex dwelling; Outfit Nr. E46L for BOQ.

(2) Lavatory (Lav) Vitreous-China, 18" x 20": The lavatory shall be vitreous china, outfit Nr. VB20 except where corner lavatory is indicated.

(3) Laundry Tray: Laundry tray shall be as indicated on the drawing.

(4) Bath Tub: Bathtub shall be outfit Nr. A60R or A60L as applicable, except as otherwise shown on the drawings or herein specified.

(5) Bath and Shower Trim (as follows):

Supply - Concealed type with 1/2" compression valves, union couplings, transfer valve, adjustable shower head and bath nozzle; American Standard Co. Nr. B-172 except with tub nozzle in lieu of foot test or approved equal for Duplex Dwellings. Shower for BOQ shall be outfit Nr. 1C except with head equal to American Standard B268.

Drain - Concealed type with overflow, chain and rubber stopper. American Standard Co. Nr. B448 F or approved equal.

Curtain Rail - Fig. 66A.

Curtain - Curtain shall be colored plastic 6 feet long, 6 feet high, with chrone plated grommets and hanger rings. Colors for curtains shall be approved by the Contracting Officer.

(6) Kitchen Sink: For Duplex Dwellings Kitchen sink shall be flat rim, two compartment, 18-8 solid stainless steel sound deadend with rubberized coating on underside. Sink shall be as detailed on the drawings and furnished complete with double compartment combination supply fitting with swing spout and rinse nozzle, combination drain with basket type strainer. Sink and trim shall be ELKAY LUSTERTONE D126 - A-DFS or an approved equal. Sink frame shall be Hudee or approved equal.

(7) Kitchen Sink for BOQ: Kitchen sink shall be flat rim, single compartment, 18-8 solid stainless steel sound deadened with rubberized coating on the underside. Sink shall be as detailed on the drawings and furnished complete with combination supply fitting with swing spout, and combination drain with basket type strainer. Sink, fittings and trim shall be ELKAY LUSTERTONE D111A-DFS or an approved equal, size 19 x 16. Sink frame shall be Hudee or approved equal.

(8) Hose Bibbs: Hose bibbs shall be figrue 88, pattern EL, all chromium-plated, with 3/4" National Standard Hose Threaded Spout.

(9) Lawn Faucet: Angle pattern, brass, fig. 104.

(10) Corner Lavatory: Fig No. 13,, Outfit No. Va7.0.

16-19 ELECTRIC STORAGE WATER HEATERS: Electric storage water heaters shall be of U. S. manufacture and shall conform to the requirements of Federal Specification W-H-196, except that dual element units will be used. Heaters shall be suitable for the available space shown on the drawings and shall operate on single phase, 60 cycle, 230 volts alternating current. Heaters shall be installed in accordance with the requirements of the section on ELECTRICAL WORK; INTERIOR, of these specifications.

16-20 RELIEF VALVES: Relief valves shall conform to the requirements of U. S. Army Specification Nr. 83-18 and shall be of U. S. manufacture. The hot-water storage tank shall be equipped with a pressure-temperature-relief valve. In no case shall a relief valve be installed with a rated capacity less than the output of the heater. Combination temperature-pressure-relief valves shall be installed in a tapping in the top of the tank. The drains from the relief valves shall be terminated as directed.

16-21 PAINTING AND FINISHING: Ferrous metal work except stainless steel surfaces, not specified to receive finish painting shall be thoroughly cleaned and given one coat of asphalt varnish. Ferrous metal to receive finish painting shall and will be painted in section on PAINTING; PROTECTIVE, ON METALS, and will be painted as specified in the section on PAINTING; GENERAL, of these specifications.

16-22 INSPECTION AND TESTS:

a. Methods of Sampling - Inspection and Tests: Methods of sampling, inspection and tests for plumbing fixtures and equipment shall conform to the requirements of section F of Federal Specification WW-P-541 or WW-P-542, as applicable.

b. Tests for Plumbing Systems: Soil, waste, vent and water piping shall be tested by the Contractor and approved by the Contracting Officer before acceptance. Piping located underground shall be tested before backfilling. Piping located in inaccessible locations such as toilet pipe spaces, furred walls, ceilings, trenches, etc., shall be tested prior to sealing in. Equipment required for tests shall be furnished by the Contractor without additional cost to the Government.

(1) Drainage System: The entire drainage and venting system shall have all necessary openings plugged to permit the entire system to be filled with water to the level of the highest vent stack above the roof. The systems shall hold this water for 30 minutes without showing a drop greater than 3 inches. Where a portion of the system is to be tested, the test shall be conducted in the same manner as described for the entire system, except that a vertical stack 10 feet above the highest horizontal line to be tested may be installed and filled with water to maintain sufficient pressure, or a pump may be used to supply the required pressure. The pressure shall be maintained for 30 minutes. If and when the Contracting Officer decides an additional test is needed, such as an air or smoke test on the drainage system, the Contractor shall perform such test as part of this contract.

(2) Water System: Upon completion of the roughing-in and before setting fixtures, the entire hot-and cold-water piping systems shall be tested at a hydrostatic pressure of not less than 100 pounds per square inch gage, and proved tight at this pressure. Where a portion of the water piping system is to be concealed, before completion, this portion shall be tested separately in the same manner as specified for the entire system. Any control or piece of equipment which has a working pressure rating lower than the test pressure shall be blocked off or by-passed and separately tested.

(3) Defective Work: If inspection or test show defects, such defective work or material shall be replaced and inspection and tests repeated. Repairs to piping shall be made with new material. Calking of screwed joints or holes will not be acceptable.

(4) Cleaning and Adjusting: At the completion of the work all parts of the installation shall be thoroughly cleaned. All equipment, pipe valves and fittings shall be cleaned of grease and metal cuttings, and sludge which may have accumulated by operation of system for testing. Any stoppage or discoloration or other damage to parts of the building, its finish or furnishings, due to the Contractor's failure to properly clean the piping system, shall be repaired by the Contractor without cost to the Government.

c. Final Test: Upon completion of installation of fixtures for the water system and at a time designated by the Contracting Officer all water piping shall again be pressure-texted for leaks as hereinafter specified. All water piping and fittings shall be tested hydrostatically and proved tight under a gage pressure of not less than 75 p.s.i. test pressure. After the above tests have been completed, and before the system is accepted, capacity and general operating tests of the systems shall be conducted by a competent and experienced engineer. The tests shall be conducted in the presence of the Contracting Officer or his authorized representative and shall cover a period of not less than 12 hours for the system, and shall demonstrate that the entire system is functioning in accordance with the specifications and to the entire satisfaction of the Contracting Officer. The Contractor shall furnish all instruments, test equipment, and personnel that are required for the tests, and the Government shall furnish the necessary fuel, water and electricity.

16-23 STERILIZATION: The entire water distribution system shall be thoroughly sterilized with a solution containing not less than 50 parts per million of available chlorine. The chlorinating material shall be either liquid chlorine conforming to U. S. Army Specification 4-1A or sodium hypochlorite solution conforming to Federal Specification O-B-441, grade D, and shall be introduced into the system in a manner approved by the Contracting Officer. The sterilizing solution shall be allowed to remain in the system for a period of not less than 8 hours, during which time, all valves and faucets shall be opened and closed several times. After sterilization, the solution shall be flushed from the system with clean water until the residual chlorine content is not greater than 0.02 per million. Necessary safety requirements shall be observed.